THE INSECT FAUNA INHABITING *UROMYCLADIUM* (UREDINALES) RUST GALLS ON SILVER WATTLE (*ACACIA DEALBATA*) IN TASMANIA

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Abstract

This study identifies the insect species utilising *Uromycladium* galls growing on *Acacia dealbata* in Tasmania and examines the relative abundance and seasonality of species using the galls as a food resource. Regular collections of galls were made over a 14 month period and the insects reared from them. The distribution of the 32 insect species reared from *U. tepperianum* galls from 13 sites in Tasmania is presented. *U. tepperianum* and *U. notabile* are recorded on *Acacia riceana* for the first time. The rare tineid, *Erechthias ancistrosema* Turner, was reared from galls at one site. Some observations on the biology and habitat of the moth are noted.

Introduction

Acacia dealbata (Link), a widely distributed wattle species in Tasmania, is often attacked by the uredineine rust fungus *Uromycladium tepperianum* (Sacc.) McAlpine. The biology of the fungus was described by Morris (1987). The commercial growth of *A. dealbata*, a valued tree species for veneer and pulpwood production in Tasmania and potentially a fast-growing general timber tree in many parts of the world, is impeded by two biotic factors. Defoliation by the fire-blight beetle *Acacicola orphana* (Erichson) (Chrysomelidae) (Elliott 1978) and branch decline caused by fungi of the genus *Uromycladium* restrict planting of this species.

This study had the aim of documenting the insects utilising *Uromycladium* galls as a contribution to the knowledge base for the production of this timber tree. Very young stressed trees or older declining trees are most susceptible with the number of galls per tree often increasing annually over many years, causing branch death and final demise of trees (Morris 1997). Over 100 species of *Acacia* have been recorded supporting this pathogen (Gathe 1971). The galls are utilized by many insect species, as both a food resource for immature and adult insects as well as a refuge for some transient species. A total of 32 insect species was reared from *U. tepperianum* galls collected at 13 sites in Tasmania. Collections were also made of *U. notabile* (Ludw.) McAlpine and new host records of this species and *U. tepperianum* on the Tasmanian endemic *Acacia riceana* Henslow are documented.

Materials and methods

Galls were collected from three sites on at least three occasions and from ten other sites on an opportunistic basis, throughout the range of *A. dealbata* in Tasmania (Fig. 1). At the three main sites collections were made over a 14 month period. These were Blackmans Bay (6 collections), Triabunna (5 collections) and Burnie (3 collections). Collected galls were transported to the laboratory in a car fridge at 8°C in individual, perforated plastic bags.

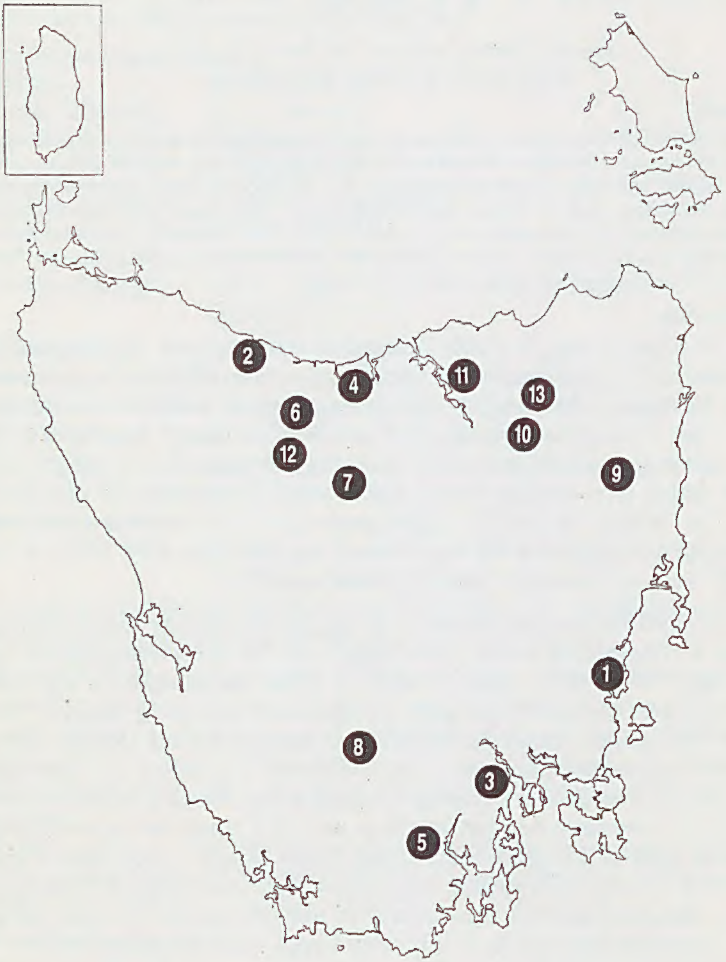

Fig. 1. Localities sampled for *Uromycladium* galls on *Acacia dealbata* in Tasmania. 1 = Triabunna; 2 = Burnie; 3 = Blackmans Bay; 4 = Wurra Wurra; 5 = Arve; 6 = Swamp Road; 7 = Lorinna; 8 = Westfield; 9 = Fingal Flats; 10 = Camden; 11 = Batman Bridge; 12 = Smiths Plains; 13 = Lisle.

Each gall was measured using vernier scale calipers for largest and smallest diameter of each gall and gall volume was calculated. Each gall was placed in an age category of young (<3-4 months) or old (>4 months), based on coloration, development and emergence exits. Young galls were all light brown in color, firm in texture, and had no emergence exits. Old galls were dark brown, hard in texture with some emergence exits (Fig. 2b). Division into age classes was done to determine when they were utilised by the immature stages of the Lepidoptera species.

In the laboratory individual galls were placed into clear plastic containers with perforated lids to prevent condensation. All galls were held at 18°C with light regime of 12h light/12 h dark, for four months. Emerging insects were removed weekly and stored either in 70% ethanol or frozen before being mounted. Retention of the galls at a constant temperature may have influenced the time of emergence of some individuals. However, collecting at different times of the year enabled emergence patterns to be assigned.

Results

Table 1 lists the Orders and species of insects inhabiting *U. tepperianum* galls on *A. dealbata* collected from thirteen sites in Tasmania. The following genera and species are not listed in Semmens *et al.* (1992). Lepidoptera: *Holocola triangulana* Meyrick (Tortricidae), *Polysoma eumetalla* (Meyrick) (Gracillariidae); Coleoptera: *Cryptarcha australis* Reitter, *Cryptarcha laevigata* Reitter, *Soronia superba* Reitter (all Nitidulidae), *Phalacrus uniformis* (Blackburn) (Phalacridae), *Araecerus palmaris* (Pascoe) (Anthribidae); Hymenoptera: *Bassas* sp. (Braconidae), *Glabridorsum stokesii* (Cameron) (Ichneumonidae). Lepidoptera nomenclature follows Nielsen *et al.* (1996).

Lepidoptera

Lawrence and Milner (1984) noted that galls caused by fungal infections are composed of relatively normal plant tissue and the lepidopterous larvae feeding on that tissue should therefore be regarded as phytophagous or saprophagous rather than true fungus feeders. New (1982) reared seven species of moths from *Uromycladium tepperianum* on *A. decurrens* growing in Melbourne .All of these species were reared in this study from Tasmanian galls except *Stathmopoda callichrysa* Lower (Oecophoridae), which is not recorded from Tasmania, and the unidentified Pyralidae.

The larvae of both *Gauna aegusalis* (Walker) (Pyralidae) and *Holocola triangulana* have been recorded burrowing in *Uromycladium* galls growing on wattles in SE Australia (Common 1990). Rawlins (1984) stated that the larvae of several species of *Stathmopoda* Herrich-Schäffer feed in rust galls on *Acacia* spp. and Common (1990) recorded both species found in this study (*S. cephalaea* Meyrick and *S. chalcotypa* Meyrick) from rust galls in southern Australia.

Table 1. Insect species emerging from *Uromycladium* galls at all sites sampled in Tasmania, with an indication of site/species similarity. Sites: 1 = Blackmans Bay; 2 = Triabunna; 3 = Burnie.

Emergent species	Main site 1	Main site 2	Main site 3
LEPIDOPTERA			
Erechthias ancistrosema Turner			x
Erechthias mystacinella (Walker)	x	x	x
Opogona comptella (Walker)			
Polysoma eumetalla (Meyrick)	x	x	x
Stathmopoda cephalaea Meyrick	x	x	x
Stathmopoda chalcotypa Meyrick			
Macrobathra Meyrick sp.	x		
Holocola triangulana Meyrick	x	x	x
Gauna aegusalis (Walker)	x	x	x
COLEOPTERA			
Cryptarcha australis Reitter	x		x
Cryptarcha laevigata Reitter	x	x	
Soronia superba Reitter	x	x	x
Carpophilus aterrimus Macleay		x	
Carpophilus hemipterus (L.)		x	
Egolia variegata Erichson			x
Titaena tasmanica Champion	x		x
Blackburniella hilaris (Westwood)		x	
Araecerus palmaris (Pascoe)	x		x
Phalacrus uniformis (Blackburn)	x	x	x
Melanterius costipennis Lea		x	
Curculionidae 7 spp.	x		x
Coccinellidae sp. A	x		
Coccinellidae sp. B	x	x	
Coccinellidae sp. C	x		
DIPTERA			
Helina R.-D. sp.			
HYMENOPTERA			
Bracon sp.	x	x	x
Dolichogenidea sp.	x	x	x
Bassas sp.	x		x
Gladridorsum stokesii (Cameron)	x		
Campoplex sp.	x	x	
Isdromas sp. 1	x	x	
Isdromas sp. 2	x		
Similarity coefficient (%)	100	65	72

Table 1 (continued). Sites: 4 = Wurra Wurra; 5 = Arve; 6 = Swamp Road; 7 = Lorinna; 8 = Westfield; 9 = Fingal Flats; 10 = Camden; 11 = Batman Bridge; 12 = Smiths Plains; 13 = Lisle.

Emergent species	4	5	6	7	8	9	10	11	12	13
LEPIDOPTERA										
Erechthias ancistrosema										
Erechthias mystacinella	x		x			x		x		x
Opogona comptella										x
Polysoma eumetalla	x	x	x		x		x		x	x
Stathmopoda cephalaea		x	x	x	x	x	x	x	x	x
Stathmopoda chalcotypa		x								x
Macrobathra sp.										
Holocola triangulana	x	x		x		x	x		x	x
Gauna aegusalis	x									
COLEOPTERA										
Cryptarcha australis		x	x					x		
Cryptarcha laevigata				x				x	x	
Soronia superba								x	x	
Carpophilus aterrimus		x								
Carpophilus hemipterus									x	
Egolia variegata										
Titaena tasmanica										
Blackburniella hilari						x				
Araecerus palmaris										
Phalacrus uniformis										
Melanterius costipennis								x		
Curculionidae 7 spp.										
Coccinellidae sp. A										
Coccinellidae sp. B										
Coccinellidae sp. C										
DIPTERA										
Helina sp.										x
HYMENOPTERA										
Bracon sp.		x	x							x
Dolichogenidea sp.	x	x				x			x	x
Bassas sp.	x	x				x			x	x
Gladridorsum stokesii										
Campoplex sp.		x								
Isdromas sp. 1		x								
Isdromas sp. 2										
Similarity coefficient (%)	47	57	29	23	23	47	23	40	45	53

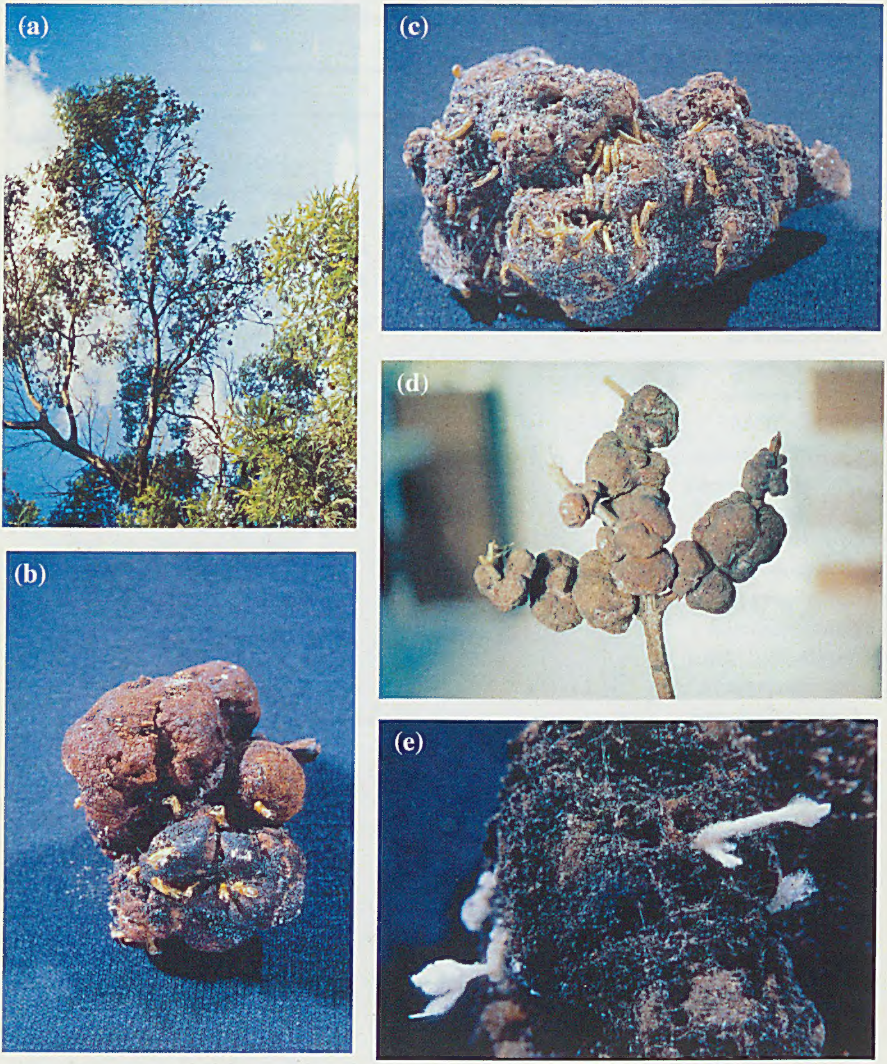

Fig. 2. *Uromycladium tepperianum* galls on *Acacia dealbata* in Tasmania. (a) decline of mature *A. dealbata* tree due to heavy infestation of galls; (b) succession of galls, young (light brown) to old (dark brown); (c) old gall with pupal emergence of *Erechthias mystacinella*; (d) typical stem-galling form of *U. tepperianum*; (e) stroma of the fungus *Paecilomyes* sp. emerging from lepidopterous hosts within the gall.

The metallic gracillariid moth *Polysoma eumetalla* (Meyrick) was common at most sites, the larvae emerging from the galls to pupate under white protective cocoons in the crevices between lobes of the galls. *Opogona comptella* (Walker) (Tineidae) and an undetermined species of *Macrobathra* Meyrick (Cosmopterygidae) were collected at a single site each.

Of interest is *Erechthias ancistrosema* Turner (Tineidae), previously known only from the holotype from Burnie and with its biology unknown. Twelve specimens were reared from galls collected at Burnie, emerging between November and February. The moth only emerged from old galls from which other species had emerged previously. One categorization of a species being rare is if it fills the criteria of occurring in low numbers compared to emergence of other members of the habitat guild and in a limited distribution within that habitat. In this case 12 specimens of *E. ancistrosema* were reared among a total of 241 moths at the Burnie site (comprising <5% of the moth population) and collected at only one site out of thirteen. All other moth species within the guild emerged from galls collected from at least three sites. Clearly *E. ancistrosema* is spatially concordant in the sense of Gaston (1994) and merits conservation measures for preservation of the species. Loss of habitat due to tree removal places this species under threat.

In some older galls collected at several sites and containing lepidopterous larvae, white stroma of the pathogenic necrotrophic hyphomycetes fungus *Paecilomyes* sp. developed, protruding from the galls to a height of three centimeters. Several galls containing the fungus were dissected and the hosts identified as lepidopterous larvae. This entomophagus fungus has been recorded attacking dipterous larvae (Stratiomyidae) in Australia. However in this study the fungus was not recorded from the Lisle site galls from which dipterous (Muscidae) emergence occurred (Fig. 2e).

Emergence of the three most common moths, *Erechthias mystacinella* (Walker) (Tineidae), *H. triangulana* and *S. cephalaea*, occurred in all months of the year, peaking in spring and summer, indicating these species may have several generations a year utilising the gall resource. The other species were summer/autumn emergents, indicating a univoltine life cycle. The rare *E. ancistrosema* emerged from October to February (Table 2).

All moths co-occurred with other moth species. At the three main collection sites, moths did not occupy 22.2% of galls collected while 42.4-53.9% of galls yielded one species of moth. A maximum of four moths per gall was recorded from one gall only. Table 3 lists the number of moth species per gall emerging from galls collected at these sites, where *E. mystacinella* was the most common moth to emerge followed by *S. cephalaea*. The degree of dominance for these two species is shown in Table 4.

The three main collection sites showed marked differences in the numbers of moths emerging throughout the year (Table 5). The Blackmans Bay site had a monthly emergence mean of 11.05 moths (1.81 species per gall), compared to Triabunna 5.68 (1.18 species per gall) and Burnie 2.4 (0.8 species per gall). There were no winter collections made at the Burnie site. All sites had the same complex of common moth species.

Table 2. Number of individuals of each moth species reared from *U. tepperianum* galls each month in Tasmania.

Moth species	Jan	Feb	Mar	Apr	May	June	
Erechthias ancistrosema		2					
Erechthias mystacinella	24	58	120	59	251	146	
Opogona comptella							
Polysoma eumetalla	5		20		18		
Stathmopoda cephalaea	85	174	173	23	101	16	
Stathmopoda chalcotypa							
Macrobathra sp.							
Holocola triangulana	35	49	87	3	40	37	
Gauna aegusalis			3	2	4		
TOTAL	**149**	**283**	**403**	**87**	**414**	**199**	
Moth species	July	Aug	Sept	Oct	Nov	Dec	**Total**
Erechthias ancistrosema				1	8	1	**12**
Erechthias mystacinella	441	363	233	238	364	190	**2487**
Opogona comptella		1			4		**5**
Polysoma eumetalla						1	**44**
Stathmopoda cephalaea	29	31	18	168	325	142	**1285**
Stathmopoda chalcotypa					2	1	**3**
Macrobathra sp.					3		**3**
Holocola triangulana	31	36	37	97	52	14	**518**
Gauna aegusalis							**9**
TOTAL	**501**	**431**	**288**	**504**	**758**	**349**	**4366**

Table 3. Number of moth species co-inhabiting *Uromycladium* galls at three sites in Tasmania.

Site	0 spp.	1 sp.	2 spp.	3 spp.	4 spp.	5 spp.
Triabunna	35	72	37	11	0	0
Burnie	40	62	12	1	0	0
Blackmans Bay	23	66	100	56	1	0
% of total	22.2	42.4	24.8	10.3	0.3	0

Table 4. Degree of dominance of the two most abundant moth species reared from *U. tepperianum* galls at three sites in Tasmania. Species A = *Erechthias mystacinella*; Species B = *Stathmopoda cephalaea*. Degree of dominance, *d = (N/NT) x 100.*

Site	Species	*d*	Species	*d*
Triabunna	A	48.44	B	44.46
Burnie	A	60.08	B	33.33
Blackmans Bay	A	66.06	B	19.28

Table 5. Total number and number of species of moths reared from *Uromycladium* galls at different times of the year.

TRIABUNNA

Collection date	No. of galls	Total no. of moths	No. of moth species	Individuals/gall (Mean ± SD}	Species/gall (Mean ± SD}
7.x.1997	40	309	3	7.9 ± 6.4	1.4 ± 0.6
13.xi.1997	41	225	3	5.5 ± 4.8	1.0 ± 0.6
23.xii.1997	11	79	4	7.3 ± 4.9	1.6 ± 0.8
18.ii.1998	31	206	3	6.7 ± 6.9	1.4 ± 1.1
16.iv.1998	33	206	3	1.0 ± 1.7	0.5 ± 0.8

BURNIE

Collection date	No. of galls	Total no. of moths	No. of moth species	Individuals/gall (Mean ± SD}	Species/gall (Mean ± SD}
24.x.1997	54	72	4	1.4 ± 1.9	0.7 ± 0.6
31.x.1997	45	117	4	2.6 ± 3.3	0.8 ± 1.1
23.i.1998	16	52	4	3.3 ± 5.2	0.9 ± 1.0

BLACKMANS BAY

Collection date	No. of galls	Total no. of moths	No. of moth species	Individuals/gall (Mean ± SD}	Species/gall (Mean ± SD}
22.ix.1997	100	742	4	7.5 ± 11.5	1.7 ± 1.0
22.xii.1997	22	198	3	9.0 ± 7.0	2.1 ± 0.9
18.i.1998	19	143	4	7.6 ± 6.7	1.5 ± 0.6
25.ii.1998	29	226	4	8.1 ± 11.9	1.7 ± 1.0
21.v.1998	28	652	3	23.4 ± 15.5	1.9 ± 0.8
19.vii.1998	48	714	4	10.7 ± 11.9	2.0 ± 0.8

Collections of old and green galls were made to determine preferences by different moth species. *E. mystacinella* and *E. ancistrosema* emerged mainly from old galls (Fig.2c), while *S. cephalaea* emerged mainly from green galls. Several of the moth species are capable of colonising and completing development in green galls. Only one species, *E. mystacinella*, demonstrated a statistically significant relationship with a gall age class as shown in Table 6 (ANOVA, $F_{2,328}$=5.70, P<0.026). The utilisation of the gall habitat is shown in Table 7. Overall, the mean gall volume used per moth was 95.26 mm^3 and the mean total gall volume for the three main sites was 289.7 mm^3. Lepidoptera occupied 95% of all green galls at the Blackmans Bay site.

Table 6. Moth emergence from young and old galls.

Moth species	Number of emerging moths	
	Old galls	Young galls
Erechthias ancistrosema	12	0
Erechthias mystacinella	2015	313
Stathmopoda cephalaea	368	555
Holocola triangulana	223	177
Gauna aegusalis	2	2

Table 7. Gall volume (mm^3) utilised by moth species at three sites in Tasmania.

Site	Gall volume/moth (Mean ± SD)	Gall volume (Mean ± SD)	Number of galls
Triabunna	66.3 ± 89.3	274.1 ± 183.6	157
Burnie	177.4 ± 172.1	362.7 ± 314.9	115
Blackmans Bay	42.1 ± 70.4	232.4 ± 218.6	246

Coleoptera

Both adult and larval stages of the phalacrid beetle *Phalacrus uniformis* feed on the surface spores covering young *Uromycladium* galls (T. Weir, pers. comm.). Larvae live in the narrow separations between the lobes of the galls while adults hibernate in old galls (Steiner 1984). This species was the most common coleopteran species (74% of all beetles collected) and present at all sites where young galls were collected.

The anthribid *Araecerus palmaris* is known to feed on and lay its eggs in *Uromycladium* rust galls. Large numbers of fungal spores are present in the hindgut of dissected adults (Zimmermann 1994). New (1984) stated that *A. palmaris* (as *Doticus pestilens* Oliff) was the most abundant beetle reared from *Uromycladium* galls in Victoria, which was not the case in this study in Tasmania. The first note on the association of *A. palmaris* with

Uromycladium galls was by Froggatt (1907). Gourlay (1929) studied the life history of this beetle in New Zealand and found both adults and larvae present in *Uromycladium* galls during winter, with the emergence of adults in November. Holloway (1982) suggested that there are two emergence periods, from March-April and Sept.-Nov. in New Zealand. In Tasmania only one emergence peak was observed, in early summer, but continued emergence between June to March may be due to sheltering adults utilising old galls. The beetle emerged from the two sites of Blackmans Bay and Burnie. At the Blackmans Bay site 15.4% of all beetles emerging from galls, which had already had some emergence by other insect species, were *A. palmaris*. The sex ratio was males : females 0.88:1 (n=95). This is the first published record of this species in Tasmania. A related species, *A. lindensis* Blackburn, was collected by Charles Darwin in Tasmania.

The weevil *Melanterius costipennis* Lea (Cryptorhynchinae) was reared in large numbers from galls collected at the Batman Bridge and Triabunna sites. Larvae were present in young galls, their tunneling hollowing out the galls. Emergence of the adults occurred during December-February. Zimmerman (1994) noted that this species has been recorded on several species of *Acacia* in Tasmania, Victoria and New South Wales and specifically recorded emerging from *Uromycladium* galls in Canberra, ACT. Members of the genus are common weevil predators of *Acacia* seed. The other curculionid species recorded all appear to be transient migrants (T. Weir, pers. comm.).

Cryptarcha laevigata, C. australis, Carpophilus hemipterus (L.) and *C. aterrimus* Macleay (Nitidulidae) are all considered to be sap rather than spore feeders. *Titaena tasmanica* Champion (Tenebrionidae) probably feeds on lichens or algae (T. Weir, pers. comm.) but larvae may graze on the surface of the galls at night (J. Lawrence, pers. comm.). It appears that these coleopterous species, along with the predaceous coccinellids and trogossid species, are all utilising the old-tunnelled galls as refuges or as habitats for prey species. Species of *Soronia* (Nitidulidae) have been reared from polyporaceous fungi in NSW (Webb and Simpson 1991). *C. australis* was recorded from *Uromycladium* galls by Tillyard (1926), who commented that the species utilised many other refuges as adults. *Egolia variegata* Erichson (Trogossitidae) was collected only from the Burnie site but is recorded as a common predator throughout much of the forested areas of Tasmania (Tasmanian Forest Insect Collection records) and, together with *Blackburniella hilaris* (Westwood) (Cleridae) and the coccinellids, may be regarded as incidentals on the galls.

Diptera

An undetermined species of *Helina* Robineau-Desvoidy (Muscidae) was collected only from the Lisle site in one collecting period. A total of 116 adults emerged over a period of 10 days in September, from a total of 15 old galls. The only lepidopterous species to emerge from the Lisle galls in this collection period was *Stathmopoda cephalaea*. The species is not parasitic or predatory but larvae may feed on dead and decomposing lepidopterous larvae within the galls (D. Colless, pers. comm.).

Hymenoptera

All of the hymenopterous species are parasitoids of larvae feeding within the galls. Both *Campoplex* sp. and *Glabridorsum stokesii* (Ichneumonidae) are recorded as generalist parasitoids of lepidopterous species. The two *Isdromas* species (Ichneumonidae) appear restricted to a tineid host (*Erechtheus mystacinella*) but may also be a hyperparasitoid of *Dolichogenidea* sp. (Braconidae) (S. Schmidt, pers. comm.). *Dolichogenidea* sp. was reared from some galls which only had the gracillariid moth *Polysoma eumetalla* emerge. *G. stokesii* was reared only from galls containing *Stathmopoda cephalaea* (Table 8). None of the galls retained individually for parasite host studies had a single species of beetle emerge without any moth species, so it was not possible to determine if any of the parasitoids utilised beetle larvae as hosts.

Parasitism levels are difficult to assess in a complex of insect species inhabiting galls. At the Blackmans Bay site the total number of lepidopterous pupal cases was counted from 246 galls and a count made of hymenopterous adults emerging from the same galls. The total number of adult insects that emerged was 3,167 (Lepidoptera 2,675, parasitoids 492). The mean number of parasitoids per gall was 2.11. This indicates a parasitism level of 15%, admitting the fact that lepidopteran larval mortality from other causes was not known. This result indicates higher levels of parasitism than that recorded by McGeoch and Chown (1997) in a similar complex of insects inhabiting *Ravenelia* galls on *Acacia* in South Africa. In that study only 0.6% of lepidopterous larvae were parasitised.

Table 8. Emergence of Lepidoptera and Hymenoptera from the same gall.

HYMENOPTERA	*Bracon* sp.	*Dolichogenidea* sp.	*Bassas* sp.	*Compoplex* sp.	*Gladridorsum stokesii*	*Isdromas* sp. 1	*Isdromas* sp. 2
LEPIDOPTERA							
Erechthias mystacinella	x	x	x			x	x
Polysoma eumetalla		x					
Stathmopoda cephalaea	x	x	x		x		
Macrobathra sp.		x	x	x			
Holocola triangulana	x	x	x				
Gauna aegusalis				x			

Impact of *Uromycladium* galls on the host plant

Uromycladium (Basidiomycota: Uredinales) is a genus native to Australia but closely related to other ravenelioid rusts distributed throughout the southern hemisphere (Orchard 1996). *U. tepperianum* forms round galls on terminal branch stems, phyllodes and the tips of flowering shoots (Fig. 2d). When formed on flowering shoots, the developing galls resemble bunches of grapes and the galls remain as single entities without developing new galls on older ones, as happens on stem inhabiting galls. A smaller guild of insects than those inhabiting stem rusts, partly due to the smaller size and longevity of the gall on the tree, occupy these galls.

New galls first appear in June/July and develop through the summer months, changing from the light brown color to a darker spore-free surface when fully developed in late autumn. During early winter the galls become hard and brittle as they die, a process frequently hastened by insect activity. The gall mass increases in size as new galls develop on older ones resulting in large irregularly shaped globular gall masses up to 100 cm^3 in volume. The galls cause death of branches and heavy infestations over several years can cause the death of mature trees (Fig 2a).

Another species of *Uromycladium*, *U. notabile*, was occasionally found developing on the phyllodes and terminal shoots of *A. dealbata*, causing growth distortion. The galls formed by this species are not globose or large and support fewer insects than *U. tepperianum*. The lepidopteran species *Polysoma eumetalla* (27 adults from 4 galls), *Erechthias mystacinella* (7 adults from 3 galls) and *Stathmopoda chalcotypa* (7 adults from 3 galls) were reared from *U. notabile* galls on *A. dealbata*.

Burges (1934) recognized seven species of *Uromycladium* in Australia, restricted to *Acacia* species except *U. tepperianum*, which also occurs on *Albizzia*. *U. tepperianum* has now been recorded on 118 known hosts in the genera *Acacia* and *Albizzia* (Gathe 1971). In this study galls of both *U. tepperianum* and *U. notabile* were found on the Tasmanian endemic *Acacia riceana*, constituting new host tree records for these fungi.

Discussion

There is little evidence to suggest that any of the moth species inhabiting *Uromycladium* galls are totally dependent on that type of gall. Other work on insect-induced galls in Tasmania demonstrates that all but one (*Erechthias ancistrosema*) also utilise other gall forms on *Acacia* species. (Bashford, in prep.). The widespread distribution of *Uromycladium*-affected *Acacia* spp. makes them an important habitat resource for insects non-dependent on induced gall formation. The importance of stable guild populations may be of importance to timber production in the future if exotic gall forming insects are introduced. Having widely distributed generalist parasitoids may reduce the impact of such exotics. This further enhances the need for reserves of succession forest that will support potential control agents within production forest areas.

At least one interesting question has emerged from this study. How important are the moths emerging as adults from young galls in the dispersal of spores? *Uromycladium tepperianum* spores are prolific on the outer surface of young galls and are easily wind dispersed. However the emergence of large numbers of moths from young galls would result in the direct dispersal of spores to other *Acacia* trees. There may therefore be a mutualistic relationship between some moths and the fungus. The moth benefits in the immature stage by having protection and a food resource while the fungus obtains direct spore dispersal.

The finding of the rare endemic species *E. ancistrosema* is important for several reasons. This study has demonstrated that the species is associated with galls. The fact that the adults only emerged from old galls indicates a long larval development period in young galls. The collection of specimens from near the holotype locality suggests that the species continues to have a very restricted distribution. Since the completion of this study, all gall-infested trees at the Burnie site have been removed due to their declining health. This practice increases the vulnerability of this species but, like other tineids, it may inhabit other gall types in the area.

Site similarity as shown in Table 1 reflects the sampling effort. The three main sites, which were sampled throughout the 14 month period, all contain a high proportion of the total number of species reared. More frequent sampling at the other sites would most likely have increased the number of species at those sites. The value of opportunistic sampling is reflected in emergence from the Lisle site galls of two lepidopterous species, both new records for Tasmania.

This study parallels much of the work reported by New (1984) and McGeoch and Chown (1997) on Lepidoptera inhabiting rust galls. The current study has taken a landscape approach to gall utilisation and an attempt has been made to determine the complete insect fauna utilizing these galls in Tasmania. The information provided in these and other ongoing studies provides the basis for future investigations of 'island' communities, examining heterogenicity of species composition, biotic interactions, community stability on a regional scale and the dynamics of rare species.

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